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CONTENTS

TWENTY-FIFTH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

The twenty-fifth meeting of the National Conference on Weights and Measures was held at the Bureau on June 4 to 7, 1935, inclusive. Although initiated in 1905 as an annual conference, this was the first meeting since 1931.

The Conference, which is sponsored by the Federal Government through the National Bureau of Standards, is an organization composed primarily of State and local weights and measures officials, designed to protect consumer purchasing as well as to effect commercial economy and efficiency by development of codes of specifications and tolerances for weighing and measuring devices, and to promote uniformity in weights and measures supervision throughout the United States.

One hundred and three State officials from Maine to Florida and as far west as Arizona were in attendance, as well as over 50 manufacturers of equipment. In all, 22 States and the District of Columbia were represented. In view of the fact that supervision of weights and measures has not as yet been provided, or is inadequately maintained, in about one-quarter of the States, the attendance this year may be considered as exceptionally representative of existing national activities. On the other hand, the situation in States which have been backward in developing proper control over weights and measures is, with betterment and standardization of existing administration, one of the primary considerations of the National Conferences.

The opening address on June 5 was delivered by E. C. Crittenden, Assistant Director of the Bureau in charge of research and testing. In the absence of Secretary Roper, Assistant Secretary of Commerce John Dickinson delivered the principal address Thursday morning, June 6. Other Federal officials who appeared on the program

were A. S. McAllister, Assistant Director of the Bureau in charge of commercial standardization; F. S. Holbrook and H. W. Bearce, co-chiefs of the Division of Weights and Measures; H. C. Dickinson, Chief of the Heat and Power Division; Ralph W. Smith, chief of the section on weights and measures laws and administration, of the Bureau; and W. S. Frisbie and L. C. Carey, of the United States Department of Agriculture.

Since the meeting in 1931 the Conference had lost, by death, its President, Dr. George K. Burgess, then Director of the National Bureau of Standards, and, by retirement, the First and Second Vice Presidents, former weights and measures officials of Indiana and Pennsylvania. The new officers chosen for the coming year are: President, Dr. Lyman J. Briggs, Director, National Bureau of Standards; First Vice President, John P. McBride, Director of Standards, Commonwealth of Massachusetts, Boston, Mass.; Second Vice President, C. D. Baucom, Superintendent of Weights and Measures, State of North Carolina, Raleigh, N. C.; Third Vice President, Martin L. Lang, Commissioner of Weights and Measures, State of Indiana, Indianapolis, Ind.; Fourth Vice President, J. C. Tinkey, Deputy Sealer of Weights and Measures, State of Ohio, Columbus, Ohio; Secretary, F. S. Holbrook, co-chief, Division of Weights and Measures, National Bureau of Standards, Washington, D. C.; Treasurer, George F. Austin, Jr., Supervising Inspector, Bureau of Weights and Measures, Detroit, Mich.

George M. Roberts, Superintendent of Weights, Measures, and Markets of the District of Columbia, at the head of the District delegation, related the local experience in "undercover" buying as an aid to proper weights and measures enforcement. The annual national consumption of 16,000,000,000 gallons of gasoline alone is indicative of the possible purchaser loss through unregulated and unchecked measuring and dispensing devices provided for automobile fuels.

Two bills pending before Congress received attention. The Byrd bill to consolidate Federal standard container legislation was discussed by L. C. Carey, of the Bureau of Agricultural Economics, United States Department of Agriculture, and the weights and measures provisions of the Copeland bill to revise the Federal Food and Drugs Act were presented by W. S. Frisbie, Chief of the Division of State Cooperation, Food and Drug Administration, United States Department of Agriculture.

Exhibits of weighing and measuring devices, confined to apparatus developed or marketed since the conference in 1931, included several of particular interest to the consumer, such as the new grocery scales which reveal to the purchaser the automatically computed price as well as weight. New types of market scales, with springs constructed of special materials and designed to function accurately regardless of temperature and climatic changes; scales with automatic printing attachments; devices for the long-distance electric recording of weighing results; automatic gasoline measuring and price computing apparatus; and scales specially designed for weighing airplanes were on view.

"Bootlegging"—the traffic in coal, gasoline, etc., from unknown sources, with difficulties arising in respect to weights, quality, and taxation—still presents a problem to all weights and measures officials and again appeared on the program with addresses and papers from several officials. S. T. Griffith, Chief of the Bureau of Weights and Measures, of Baltimore, Md., spoke on "The Control of 'Bootleg' Coal." S. H. Wilson, Oil Chemist of the State of Georgia, dealt with "Nontax Paid Gasoline and Oil."

Philadelphia has instituted a unique board of arbitration, representing all city weights and measures officials and merchants and trade associations. This board meets frequently to consider reports of violations, applications for licenses, and matters of general administrative policy. The exceptionally good results thereby attained were presented by Edwin C. Emhardt, Supervisor of the Bureau of Weights and Measures, Philadelphia.

Others appearing on the program included C. D. Baucom, Superintendent of Weights and Measures, of North Carolina, "Weights and Measures Regulations"; B. W. Ragland, Chief of the Bureau of Weights and Measures, Richmond, Va., "Temperature of Gasoline in Under-Ground Storage"; D. V. Stroop, Secretary of the Division of Marketing, American Petroleum Institute, "Petroleum Products"; Martin L. Lang, Commissioner of Weights and Measures, Indiana, "Sealed Cans for Lubricating Oil"; M. J. J. Harrison, Chairman of the Committee on Yards and Terminals of the American Railway Engineering Association, "Motor Truck Scales"; Willard E. Reed, Superintendent of Weights and Measures, Newark, N. J.,

"Testing of Beer Barrels"; J. C. Tinkey, Deputy State Sealer, Ohio, "Positioning of Scales for Customer Observation"; and E. B. Holton, Assistant Superintendent of Weights and Measures, New Jersey, "Supervision Over the Buying of Old Gold."

Sessions of the Conference during the first 3 days were held in the East Building of the Bureau, and that on the concluding day at the Washington Hotel. The proceedings of the Conference will appear later, in printed form, as a Miscellaneous Publication of the National Bureau of Standards.

THIRTEENTH ANNUAL CONFERENCE OF STATE UTILITY COMMISSION ENGINEERS

The Thirteenth Annual Conference of State utility commission engineers was held at the Bureau on June 6–8. Twenty-six engineers, representing the commissions of the States of Connecticut, Florida, Maine, Maryland, Missouri, New Hampshire, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Washington, West Virginia, and Wisconsin, and the District of Columbia, attended the sessions. Representatives from the Federal Power Commission, Interstate Commerce Commission, Rural Electrification Administration, and the United States Bureau of the Census were present at one or more sessions.

The following papers were read: Taxes paid by utilities, Harry Barker, Vermont; Effect of recent court decisions on utility regulation, J. W. Carey, Washington; Cost of electrical distribution, G. H. Morse and C. R. Bennett, Federal Power Commission; Effect of the high cost of wiring and appliances on the use of electrical energy, J. C. Damon, Wisconsin; Some thoughts and discussion regarding water utility service and regulation, John E. Goodwin, Maine; The telephone industry, A. B. Greene, Florida; Economic investment in transmission equipment, R. E. Purucker, G. P. Steinmetz, and W. A. Kuehlthau, Wisconsin; Factual data—propane and butane plants in Maryland, Charles E. Thornton, Maryland; Bus transportation, service, safety, rates, effect of motor-bus code, Joseph T. Wadhams, Connecticut; Discussion of bus transportation, H. C. Eddy, New Jersey; Determination of the physical condition of a pipe line, K. H. Logan and I. A. Denison, National Bureau of Standards.

A small number of each of these papers is available for distribution to State utility commission engineers upon application to the secretary of the Conference.

The Conference was in charge of an executive committee of engineers as follows: Harry Barker, Chairman, Vermont; P. L. Holland, Vice Chairman, Maryland; J. H. Wiley, North Dakota; L. G. Krause, Pennsylvania; E. H. Morris, West Virginia.

The executive committee elected to make arrangements for the 1936 Conference is as follows: P. L. Holland, Chairman, Maryland; A. B. Greene, Vice Chairman, Florida; E. H. Morris, West Virginia; M. R. Williams, Tennessee; J. W. Carey, Washington; J. Franklin Meyer, National Bureau of Standards, Washington, D. C., is the Secretary of the Conference.

LEAKS IN UNDERGROUND PIPE LINES

The corrosion of thousands of miles of pipe lines buried underground and used to transport water, oil, and gas is a source of great expense to the owners and operators. It seldom happens that an entire pipe line becomes so badly corroded as to be worthless, but many lines occasionally develop leaks because of corrosion. These leaks are difficult to find since the pipe lines are often several miles from the nearest road. As the escaping fluid is often dangerous and destructive besides being valuable, the leaks must be found and repaired as quickly as possible. Pipe-line companies have developed efficient organizations and methods for this work.

Occasionally short sections of pipe lines continue to develop numerous leaks. It is sometimes more economical to uncover and recondition, or even replace, these short sections than to continue to repair them, but it is difficult to decide just what parts, if any, of a pipe line should be reconditioned because the operator does not know how many future leaks to expect in any particular section of the line.

A study made by representatives of the National Bureau of Standards and the American Gas Association of the leaks on two pipe-line systems has shown that there is some regularity in their occurrence, so that it is possible to estimate the number of future leaks in any section of a line from its past history. Formulas have been developed at the Bureau which may be used to determine the most economical time to recondition any section of a pipe line. In order to use these formulas the operator must know the average cost of repairing a leak and the cost per foot of reconditioning the pipe line.

SEPARATION OF PETROLEUM HYDROCARBONS WITH SILICA GEL

In the investigation of the chemical constitution of petroleum in progress at the Bureau, a method for the removal of aromatic hydrocarbons from the other constituents is essential. A simple laboratory method devised for this purpose is described in RP809 in the July number of the Journal of Research. It utilizes the adsorption of aromatic hydrocarbons by silica gel, the adsorbed material being recovered by displacement with water.

The fractionation (by filtration through columns of silica gel) of a number of binary mixtures of pure hydrocarbons boiling from 80 to 175° C showed that the aromatic and olefin hydrocarbons were completely removed from the paraffin and naphthene hydrocarbons. The capacity of the gel as an adsorbent was found to be three times as great for the aromatic hydrocarbons as for "diamylene", the only olefin investigated. The capacity of the gel to adsorb aromatic hydrocarbons depends on the concentration of the solution from which the aromatic hydrocarbon is adsorbed.

A small but definite separation of naphthene from paraffin hydrocarbons occurred on filtering through silica gel, the naphthene tending to be adsorbed in preference to the paraffin.

A slight separation of the normal paraffin hydrocarbons of different molecular weights was effected by filtration through silica gel, the paraffin of low molecular weight being preferentially adsorbed.

At room temperature silica gel had no deleterious effect on the aromatic, naphthene, or paraffin hydrocarbons investigated.

SEPARATION OF DIMETHYLCYCLOHEXANE FROM MIDCONTINENT PETROLEUM

Analyses of petroleum by distillation generally indicate the presence of a considerable quantity of material boiling between 116 and 121° C. This is not surprising in view of the fact that the boiling points of at least four isomeric octanes, cycloheptane, and the *cis-* and *trans-* forms of the two dimethylcyclohexanes are reported to lie within this range. The general nature of the constituents of this fraction of petroleum has been indicated by a number of investigators, but they have generally preferred to classify the compounds as isooctanes and octonaphthenes. The aim of Project 6 of the American Petroleum Institute at the Bureau is to improve upon the situation, if possible, by supplementing distillation with other tools in an attempt to separate the constituents in a state of sufficient purity to make identification possible.

After 19 distillations of the fraction boiling between 100 and 129° C, and the removal of toluene, 2-methylheptane, and *n*-octane from it by crystallization, a naphthenic constituent boiling at 119 to 121° C was concentraded sufficiently to be removed by crystallization with liquid methane. A 330-ml portion of the best of this material obtained by distillation and crystallization was intensively purified to obtain a sample for the determination of the physical properties. The boiling point, density, refractive index, carbon-hydrogen ratio, and approximate heat of fusion were determined. Photomicrographs of the crystals and infrared-absorption spectrograms were obtained.

Samples of purified *m-* and *p*-xylene were hydrogenated and partially purified by crystallization. From the properties of these products and their behavior on crystallization, it was concluded that the material isolated from petroleum was probably chiefly *m*-dimethylcyclohexane.

Photomicrographs show more than one crystal form in the petroleum sample and in the two synthetic products. The higher-melting crystal form of the octonaphthene from petroleum resembles in appearance, but is not identical with, the major constituent of the hydrogenated *p*-xylene as shown by "seeding" experiments under the microscope. Similar experiments show that the higher-melting constituent of the hydrogenated meta compound is identical with the major constituent of the petroleum fraction.

The infrared spectrogram of the petroleum sample resembled that of both the synthetic samples, but was not identical with either.

It was concluded that the material isolated from petroleum was chiefly *m*-dimethylcyclohexane with sufficient of another isomer present to exceed a eutectic composition of the isomers. It was estimated that the material was present in the original crude oil to the extent of not less than 0.15 percent by volume. A more complete account of this work will be found in the July number of the Journal of Research (RP868).

THERMAL SPALLING OF FIRE-CLAY BRICK

A discussion of the probable relation between linear thermal expansion, modulus of rupture, modulus of elasticity, and the resistance of fire-clay brick to thermal spalling is presented by R. A. Heindl in a current issue of the American Refractories Institute Bulletin.

Because of the readiness with which the linear thermal expansion of the usual type of fire-clay brick decreases, or in the case of the siliceous type of brick increases, when heated to a temperature higher than that reached during the manufacturing process, and also because of the temperature gradient in bricks which are being heated or cooled (as in furnace walls), large stresses may be set up in the bricks. Unless the bricks have the necessary extensibility, or ability to "stretch" a suitable amount to permit adjustment of the various sections of the brick to these stresses, rupture will take place. The extensibility of refractory bricks or shapes is decreased as a rule (a) with increase of temperature of firing during manufacturing, (b) by using comparatively fine grog sizes in their composition, (c) by decreasing the amount of grog. Refractory shapes apparently show less resistance to thermal shock if they contain vitreous rather than porous grog. Furthermore, of two brands of bricks which have approximately the same properties at room temperature, the brand showing the greatest decrease in extensibility between room temperature and 600° C (1,112° F) will have the lower resistance to thermal shock.

Values for Young's modulus of rupture are compared for individual units of the same brand of bricks as well as of specimens cut from different parts of the same unit to show the uniformity of the product. A comparison of the elasticity values obtained on 2 units each of 3 brands of bricks showed the difference between the 2 units to range from about 0 to 72 percent. However, when comparing the values obtained on 6 specimens from 1 brick, the modulus of elasticity may vary more than 180 percent.

DETERMINATION OF BORIC OXIDE IN GLASS

In a note in Technical News Bulletin 206 (June 1934) a modified method for the determination of boric oxide in glass was outlined. Since then it has been found that the final para-nitrophenol end point is not always sharp enough to give satisfactory results. This condition apparently results either from small amounts of impurity in the ether or from allowing the alkaline ether-alcohol solution to stand too long before complete removal of the ether and alcohol.

Impurities in the ether were successfully removed by passing it in a very fine stream through alkaline permanganate of potash (adapted from Palkin and Watkins, Ind. Eng. Chem. 21, 863 (Sept. 1929). The long contact is avoided by promptly removing the ether and alcohol by evaporation and subsequent boiling.

Instead of using 51.2 percent of the proportional amount of boric oxide extracted by the 50 ml aliquot, it has been found more satisfactory to compute the boric oxide in the sample from the "distribution constant", which has been found to be 0.406. If A represents the amount of boric oxide, determined by titration, in 1 ml of the 50 ml aliquot of the ether-alcohol layer, $2.463A$ represents the amount of boric oxide in 1 ml of the water layer. The total boric oxide in the sample becomes the sum of the products of A times the total volume of the ether-alcohol layer, and $2.463A$ times the total volume of the water layer.

Following the above procedure, boric oxide has been determined in glasses and synthetic mixtures containing from 0.7 to 12.6 percent with an average error of 0.08.

The method has been found satisfactory for all glasses studied except those containing zinc, barium, and fluorine. These three elements interfere and cause low results.

USE OF 8-HYDROXYQUINOLINE IN DETERMINATIONS OF ALUMINUM, BERYLLIUM, AND MAGNESIUM

Among the methods that may be used for the separation of aluminum from beryllium and magnesium, the precipitation of aluminum by 8-hydroxyquinoline from an acetic-acid solution, buffered with ammonium acetate, is most attractive because of its simplicity. This procedure is of particular importance in determinations of beryllium, because, after preliminary separations have removed interfering elements, aluminum, together with iron, titanium, and zirconium, is quantitativey precipitated by 8-hydroxyquinoline, after which beryllium is precipitated as the hydroxide. In RP813 in the Journal of Research for July, a method is described in which aluminum is precipitated, as the oxyquinolate, from a solution of definite hydrogen-ion con-

centration, and determined either by weighing the dried precipitate or by dissolving the precipitate in hydrochloric acid and titrating the solution with standard postassium bromate. Experiments show that when amounts of aluminum not exceeding 50 mg are determined gravimetrically, the results are accurate to approximately + 0.2 mg. With the volumetric procedure, results of equal accuracy are obtained if the aluminum does not exceed 25 to 30 mg.

RELATION OF GRAIN SIZE TO CONDITION OF ALUMINUM-ALLOY PROPELLER BLADES

The periodic inspection of aluminum-alloy airplane propeller blades, as practiced by some users, consists in anodic etching of the entire blade surface. In this way surface discontinuities are made more prominent and so are more easily detected. The grain structure at the surface of the metal is also revealed. The fact that in many blades the anodically etched surface shows a marked variation in grain size in different parts of the blade has often aroused suspicion concerning blades otherwise satisfactory in their appearance. Recently the Bureau made a survey by metallographic examinations and tensile-strength determinations of an alloy blade showing marked local differences in grain size.

The smallest grains were found in the round shank and the tip of the blade, whereas extremely large grains were found in the middle part of the blade. In general, the grain size seen on the surface persisted throughout the thickness of the blade. The highest tensile and yield strengths were obtained for the specimens from the shank. Specimens from the flattened portion of the blade did not differ significantly in strength, but the ductility, as measured by elongation and reduction of area of the fractured tensile-test specimens, increased progressively from the shank to the tip, probably in accordance with the increase in amount of deformation in forging the blade to shape. In general, the results did not support any general condemnation of propeller blades on the basis of unusual grain-size characteristics alone.

PREPARATION OF LARGE SINGLE CRYSTALS OF COPPER

The crystals which constitute a metal are ordinarily too small to permit their separation and the determination of the properties of the individual crystals. Several methods, however, have been developed for the laboratory preparation of metallic crystals so large that test specimens can be prepared, each consisting of only one crystal. In the section of chemical metallurgy at the Bureau a modification of the Bridgman method has been employed, whereby single crystals of copper several inches in length and up to 2½ inches in diameter were prepared. Orientation of the structure in these single-crystal specimens was determined by means of selective etchants which reveal the location of certain of the crystal faces.

REFRACTIVE INDICES OF CRYSTAL GRAINS

Minerals and chemical compounds are often identified by means of the immersion methods for determining refractive index. In some of these methods, final match in refractive index between a crystal and a liquid is attained by varying the temperature, but the impossibility of obtaining interference figures (by which the true orientation of the crystal grains is known) has been a serious limitation. In the July issue of the Journal of Research (RP814), a thin cell is described which overcomes this obstacle, so that it is possible to know the exact orientation of the crystal grains which are chosen for identification.

INFRARED ARC SPECTRUM OF CHROMIUM

The spectrum emitted by the neutral atom of chromium is now known to include more than 3,000 wave lengths in the range accessible to photographic observation with high-power spectrographs. All of this range has been recorded during the past 15 years in various investigations carried on in the Bureau's spectroscopy laboratory. The purpose of these investigations was to secure a homogeneous set of wavelength data on which to base a term-analysis of the first, or arc, spectrum of chromium. Considerable progress in analyzing this very complex spectrum has been made, both at the Bureau and elsewhere, in establishing most of the septet and quintet system terms required by atomic theory. But the theory also requires an extensive set of triplet- and singlet-system terms, none of which (except three odd terms of the triplet system) had been revealed in the earlier investigations. In some recent work, described in RP812 in the July number of the Journal of Research, the infrared portion of the

spectrum has been extended with the aid of the new types of plates now available for infrared photography. The new wave-length data have made it possible to unravel a large part of the triplet system, with the result that nearly all the strong lines of Cr I may now be classified as combinations between terms of the three systems. No singlets have as yet been found.

BRIGHTNESS METER FOR SELF-LUMINOUS DIALS

A compact, self-contained apparatus, which can be used to determine the brightness, in microlamberts, of a self-luminous dial, is described in RP804 in the July number of the Journal of Research. The arrangement consists of a translucent-glass disk uniformly illuminated from the back by a flashlight bulb. An opaque stencil, cut to match the figures on the dial to be tested, is fitted to the front of the disk. The intensity of illumination and, therefore, the brightness of the face of the glass disk is controlled by a Wheatstone-bridge arrangement which regulates the current through the bulb, supplied by two flashlight dry cells. A milliammeter is connected to show the out-of-balance current of the Wheatstone bridge and may be calibrated directly in microlamberts. The range of the apparatus is from 1 to 50 microlamberts, which upper limit exceeds the brightness of any commercial dials now made. The device is quite portable and can be used to test dials mounted in instrument panels without dismounting them.

PERMANENCE OF WRITTEN SIGNATURES

Recently a letter was received at the Bureau concerning the fading of signatures on important documents. In its printed publications and in replies to individual inquiries the Bureau has many times referred to the bad practice of using a blotter to dry signatures on documents which should remain legible for many years.

On important state papers, commissions, and legal documents a blotter should never be used. Its employment in a busy office can be excused, particularly as most correspondence is only of temporary value, but it should always be remembered that to remove the greater part of the ink instead of letting it soak into the paper and dry there, shortens the life of the writing. This is entirely apart from the quality of the paper, which, in ordinary correspondence, may not be goog enough to justify much worry as to the permanence of the ink signature. In the case of important documents, it is, of course, understood that a high-grade permanent paper will be used.

IRON GALLATE INKS—LIQUID AND POWDER

A general study of iron gallate writing ink was undertaken at the Bureau in an attempt to improve the keeping quality of ink, without increasing the acid content. All inks of this type contain iron, and since the standard ink contains 3 grams of iron per liter, this figure was used as the starting point in devising the ink formulas. Experimental inks, using different materials in varying concentrations, were prepared and tested according to the procedure given in the Federal Specification for writing ink. It was found that the use of gallic acid without tannic acid produced an ink with greater stability, and consequently the acid content could be decreased. This, in turn, decreased the corrosion of steel pens. The resulting ink had remarkably good stability. It was found that this modified formula could be adapted to the preparation of an ink powder without changing the characteristics of the ink. The ink powder, if properly prepared, does not readily take up sufficient moisture to form a cake. These results are reported in full in the Journal of Research for July (RP807).

ACCELERATED SETTLING TEST FOR PAINT

An iron-oxide paint, to be used as an automobile primer, was found to pass the current Federal Specification in all respects, when tested at the Bureau last February. Three months later this primer was found to be badly settled in the container. The type of settling was a hard, dry cake in the bottom of the can. This suggested the development of an accelerated-settling test to predetermine the settling tendencies of a paint, particularly one freshly manufactured. The following simple test was found satisfactory:

Pour 250 ml of the mixed paint in a 12-ounce screw-cap glass bottle (2¼ inches inside diameter). Let stand 18 hours at 90 to 100° F. Centrifuge for ½ hour at 750 rpm at a radius of 6½ inches. Let stand 5 hours at 90 to 100° F. Centrifuge for another ½ hour at 750 rpm. Repeat this cycle for another 24 hours (48-hour test). The layer of settled pigment shall be *soft*, not hard and dry. Using a stirring rod (not over 6 mm diameter),

the paint (without pouring off the liquid) shall mix within 1 minute to a uniform condition and give a smooth film.

The sample in question would not pass this specification, while others known to have good settling properties passed the test. For this type of paint it is estimated that the accelerated test is equivalent to about 6 months of normal shelf storage.

EFFECT OF HYDROSTATIC PRESSURE ON RUBBER-SULPHUR COMPOUNDS

The values of the dielectric constant, power factor, and conductivity of the insulation surrounding communication cables greatly affect the speed with which the messages may be transmitted and the amount of distortion which the message undergoes. Since submarine cables are sometimes subjected to high hydrostatic pressure, the effect of pressure on the electrical properties of materials which might possibly be used as insulating materials for such cables is of interest. RP806 in the Journal of Research for July presents the results of a study of the effect of hydrostatic pressure on these electrical properties for rubber-sulphur compounds containing from 0 to 32 percent of sulphur. This is part of a systematic study which has been made at the Bureau on the electrical properties of rubber-sulphur compounds.

The specimens were subjected to hydrostatic pressures up to 700 bars (approximately 690 atmospheres). This is the pressure which is encountered at a depth of about 4.3 miles below the surface of the ocean. For those percentages of sulphur which are generally used in commercial soft-rubber compounds the effect of pressure on the electrical properties is negligibly small. Each of the properties increased with pressure for certain ranges of sulphur content and decreased for other ranges. These results are of interest, aside from any practical value which they may have, because they may contribute to our knowledge of the structure of the rubber.

A number of the fundamental processes in wool manufacture, such as scouring and felting, involve the use of alkaline agents. Wool is sensitive to alkalies, and a knowledge of the nature of the reactions involved is obviously basic to the control of these processes. The effect of alkalies on wool has been studied by many workers, generally from the standpoint of the effect of these reagents on the physical properties of the fiber. An investigation described in RP810 in the July number of the Journal of Research was undertaken to obtain quantitative data on the effect of alkalies on both the physical and chemical properties of wool. Such data are of importance in interpreting the susceptibility of wool to alkaline agents.

When wool is treated with dilute sodium-hydroxide solutions, a rapid splitting off of a portion of the sulphur occurs. On continued treatment, the sulphur content of the residual wool approaches a constant value of about 1.8 percent. The results indicate that the alkaline treatment has changed a portion of the sulphur to a form which tends to resist further splitting from the molecule. Oxidizing and reducing agents attack the disulphide groups and make wool more susceptible to alkaline treatments. The susceptibility of untreated wool to alkaline reagents appears to be closely associated with the lability (chemical instability) of its sulphur in alkaline solutions.

GLASS-ELECTRODE ASSEMBLY FOR MEASURING THE pH OF LEATHER

The glass electrode has been shown to function under conditions which are not favorable to either the hydrogen or quinhydrone electrode. Until recently this has not been considered practical as a routine method of pH measurement, since the high resistance of the glass required vacuum-tube amplification to obtain the desired sensitivity. Glass electrodes are now available, having much lower resistance, which may be used in the conventional potentiometric system by substituting a galvanometer of high sensitivity and suitable characteristics in the electrical circuit. In view of the general use of pH measurements in specification and control work in the leather industry, a method which is rapid and accurate is desirable. A study has therefore been made at the Bureau of a simple glass-electrode assembly for measuring the pH value of leather extracts and tannin solutions. In the July number of the Journal of Research (RP805) a standard method is proposed and the details of operation noted which are essential for accurate routine pH measurements.

SEPARATION OF CORNSTALKS INTO LONG FIBERS, PITH, AND FINES

Miscellaneous Publication M14-8, which has just been released, describes a modification of the wet method of separating pith from cornstalks. The method developed at the Bureau gives

three fractions of useful materials. The procedure consists of wet shredding, washing, breaking the pith loose from the long fibers, wet screening the long fibers free from dirt, pith, and fines, and separating the pith by water flotation from the remaining material. One ton of cornstalks yields: 0.425 ton of long fiber, 0.05 ton of pith, and 0.225 ton of "fines." The properties and uses of the three fractions are given and discussed. Copies of this publication are obtainable from the Superintendent of Documents, United States Government Printing Office, at 5 cents per copy.

PERFORMANCE SPECIFICATION FOR HOSIERY

Every woman would like to know how to select the best stockings which are sold at the same or at different prices. Experience has taught her that there is a great difference in the wearing qualities of stockings which have the same color, feel, appearance, size, and which are sold at the same price. The General Federation of Women's Clubs recognized the need of adequate guides for buying hosiery several years ago and requested the assistance of the Bureau in supplying suitable test methods to serve as a basis for a performance specification for women's full-fashioned silk hosiery. As a result of this request the hosiery testing machine (BS J. Research 12, 543 (May 1934) RP679) was developed. A study was made of various factors affecting the performance of hosiery on this machine. The results of this study were also published (J. Research NBS, 14, 1 (January 1935) RP753).

Miscellaneous Publication M149, which has just been released, gives the results obtained on the hosiery-testing machine on women's full-fashioned hosiery which were purchased from 14 retail stores located in 8 large cities in different parts of the United States. The brand, retail price, appearance, and construction were found to be inadequate guides to the performance of the stockings as indicated by tests on the hosiery-testing machine, which repeatedly distends the upper part of the leg of the stocking and subjects it to forces similar to those acting on the stocking in use. The physical characteristics evaluated in this test are "distensibility" or ease with which a stocking can be distended, "recoverability" or ability of the stocking to retain its shape after being repeatedly distended; and "stretch-endurability" or ability of the stocking to withstand the tendency to develop a hole or run when the stocking is repeatedly distended from 13.3 to 21.3 inches in circumference.

Minimum limits for "distensibility", "recoverability", and "stretch-endurability" of a stocking; a classification of hosiery based upon the thickness of two layers of the leg fabric of the stocking; tolerances for size and length of the stocking; and a requirement for color fastness to laundering are recommended for use in a performance specification for women's full-fashioned silk hosiery. The specification adopted by the General Federation of Women's Clubs is based upon these recommendations.

Copies of this publication are obtainable from the Superintendent of Documents, United States Government Printing Office, Washington, D. C., at 5 cents each.

DETERIORATION OF VEGETABLE-TANNED LEATHERS BY SULPHURIC ACID

A recent investigation at the Bureau has disclosed that adding sulphonated cod-liver oil to vegetable-tanned leather in an amount equal to 10 percent of the weight of the leather does not protect the leather from deterioration by sulphuric acid. The oil apparently increased the effect of the acid on the leather tanned with chestnut-wood extract. All of the leathers which had a pH lower than 3 showed deterioration after 2 years' aging.

These results, which are reported more fully in the July Journal of Research (RP811), are in accord with those of previous work at the Bureau, where a study of the effect of sulphuric acid on leather has been in progress for some time. In the course of this study it was shown that vegetable-tanned leather having a pH lower than 3 is liable to deterioration on aging. Also, it was shown in a previous publication that the addition of 20 percent of a mixture of equal parts of beef tallow and ordinary cod-liver oil has no influence on the deterioration of leather by sulphuric acid. Thus, it is found that materials of the type ordinarily used in commercial practice for oiling heavy leather do not protect the leather from the effects of sulphuric acid.

NEW AND REVISED PUBLICATIONS ISSUED DURING JUNE 1935

Journal of Research [1]

Journal of Research of the National Bureau of Standards, title page and contents to vol. 13, July to December 1934 (RP691 to 752, inclusive). Free on application to the Bureau.

Journal of Research of the National Bureau of Standards, vol. 14, no. 6, June 1935 (RP794 to 803, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers [1]

[Reprints from the April 1935 Journal of Research]

RP775. Accuracy of high-range current transformers. J. H. Park. Price 5 cents.

RP776. Standard conditions for precise prism refractometry. L. W. Tilton. Price 5 cents.

RP777. Effect of granulometric composition of cement on the properties of pastes, mortars, and concretes. J. A. Swenson, L. A. Wagner, and G. L. Pigman. Price 5 cents.

RP778. Chemical reactions in the lead storage battery. G. W. Vinal and D. N. Craig. Price 5 cents.

RP779. Relation of ink to the preservation of written records. E. W. Zimmerman, C. G. Weber, and A. E. Kimberly. Price 5 cents.

RP781. Infrared spectra of noble gases (10500 to 13000 A). W. F. Meggers. Price 5 cents.

RP782. Effect of calcium chloride on portland cements and concretes. P. Rapp. Price 5 cents.

Miscellaneous Publications [1]

M148. Separation of cornstalks into long fibers, pith, and fines. E. R. Whittemore, C. B. Overman, and B. Wingfield. Price 5 cents.

M149. A basis for a performance specification for women's full-fashioned silk hosiery. H. F. Schiefer and R. S. Cleveland. Price 5 cents.

Technical News Bulletin [1]

Technical News Bulletin no. 218, June 1935. Price 5 cents. Obtainable by subscription.

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C.—Subscription for Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

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LC442. Books on watchmaking and timepieces.

LC443. Status of municipal plumbing codes.

OUTSIDE PUBLICATIONS [2]

Some data concerning the coverage of the five-megacycle standard frequency transmission. E. L. Hall. Proc. Institute of Radio Engineers (33 West 39th St., New York, N. Y.), **23**, 448 (May 1935).

A filter for obtaining light at wave length 560 millimicrons. K. S. Gibson. J. Optical Soc. Am. (Cornell University, Ithaca, N. Y.), **25**, 131 (May 1935).

A method for determining whiteness of paper. D. B. Judd. Paper Trade J. (10 East 39th St., New York, N. Y.), **100**, 40 (May 23, 1935).

Heats of reaction of the system: Rubber-sulphur. A. T. McPherson and N. Bekkedahl. Ind. Eng. Chem. (Mills Building, Washington, D. C.), **27**, 597 (May 1935).

The effect of sulphuric acid on chrome-tanned leather. E. L. Wallace, John Beek, Jr., and C. E. Critchfield. J. Am. Leather Chemists Assn. (Ridgway, Pa.), **30**, 311 (June 1935).

Continuous flow corrosion tests of steel pipe. H. S. Rawdon and L. J. Waldron. Preprint no. 28, Annual Meeting, Am. Soc. Testing Materials (260 South Broad St., Philadelphia, Pa.)

Specification for foundry silica sand for use in foundry of Naval Gun Factory, O. S. 905. (U. S. Naval Gun Factory, Washington, D. C.) (May 1935).

Bureau of Standards helps cities. V. B. Phelan. The American City (470 Fourth Ave., New York, N. Y.), **50**, 42 (June 1935).

[2] These publications are not obtainable from the Government unless otherwise stated. Requests should be sent direct to the publishers.

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